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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/735,370
Filing Date: December 12, 2003
Appellant(s): ACKERMAN ET AL.

Shawn K. Leppo
For Appellant

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GROUP 1700

EXAMINER'S ANSWER

This is in response to the appeal brief filed December 8, 2005 appealing from the Office action mailed July 11, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

NEW GROUND(S) OF REJECTION

(A) Claims 13-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Subramanian (US 6296945) in view of Stoffer et al (US 5932083).

(B) Claims 13-17 are rejected under 35 U.S.C. 103 as being unpatentable over Subramanian (US 6296945) in view of Stoffer et al (US 5932083).

(C) Claims 1-7, 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian (US 6296945) in view of Stoffer et al (US 5932083) and Ueda et al (US 5697992).

(D) Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian in view of Stoffer and Ueda as applied to claims 1-7, 9 and 11 above, and further in view of Taylor et al (US 5520516).

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,296,945	SUBRAMANIAN	10-2001
5,697,992	UEDA ET AL	12-1997

5,520,516	TAYLOR ET AL	5-1996
5,932,083	STOFFER ET AL	8-1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. **Claims 13-17 stand finally rejected under 35 U.S.C. 102(b) as being anticipated by Subramanian (US 6296945).**

Claim 13: Subramanian teaches a method for preparing a protected article.

Column 2, lines 20-40. The article is provided. *Column 3, lines 50-68.* A bond coat is deposited onto an exposed surface of the article. *Column 4, lines 5-20 and figure 2.* A thermal barrier coating is formed on an exposed surface of the bond coat. *Column 4, lines 50-65 and figure 2.* To form the thermal barrier coating, first a primary ceramic coating is applied to an exposed surface of the bond coat. *Column 2, lines 25-45 (the "base" or "primary" ceramic is preferably yttria stabilized zirconia, for example).* Then a sintering inhibiting material is applied to the surface of the primary ceramic coating. *Column 2, lines 25-45, column 5, lines 30-65 and figures 2-3 (the sheath material).* The sintering inhibiting region can comprise cerium oxide in a concentration greater than a general cerium oxide concentration in the primary ceramic coating. *Column 2, line 65 through column 3, line 10 and column 5, lines 30-50 (cerium (Ce) can be provided as component C of the sheath material, thus providing Ce_zO_w , and furthermore, C is desirably not the A or B material of the primary ceramic (A = zirconia and B=yttria if yttria stabilized zirconia is used as*

the primary ceramic, for example)). The resulting applied material can be a stable oxide of C_zO_w , where $C=Ce$, and therefore, Ce in the +4 oxidation state is provided. Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-45 (as z and w are not defined, it indicates that all possible stable cerium oxides can be used, including CeO_2 , which would be "at once envisaged" from the provided formula, and which would provide Ce in the +4 oxidation state as claimed).

Claim 14: the article is a nickel base superalloy article. Column 3, lines 50-68.

Claim 15: the article is in the form of a component for a gas turbine engine.
Column 3, lines 50-68.

Claim 16: the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat. Column 4, lines 5-20.

Claim 17: the primary ceramic coating can be yttria stabilized zirconia. Column 2, lines 40-50.

2. Claims 1-7, 9 and 11 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian (US 6296945) in view of Ueda et al (US 5697992).

Claim 1: Subramanian teaches a method for preparing a protected article. Column 2, lines 20-40. The article is provided. Column 3, lines 50-68. A bond coat is deposited onto an exposed surface of the article. Column 4, lines 5-20 and figure 2. A thermal barrier coating is formed on an exposed surface of the bond coat. Column 4, lines 50-65 and figure 2. To form the thermal barrier coating, first a primary ceramic coating is

applied to an exposed surface of the bond coat. *Column 2, lines 25-45 (the "base" or "primary" ceramic is preferably yttria stabilized zirconia, for example).* Then a cerium oxide compound can be applied to the surface of the primary ceramic coating. *Column 2, lines 25-45, column 4, lines 55-68, column 5, lines 30-65 and figures 2-3 (cerium (Ce) can be provided as component C of the sheath material, thus providing Ce_zO_w).* The cerium oxide precursor material can be infiltrated into the primary ceramic coating. *Column 4, lines 55-68, column 5, lines 35-45 and figures 2-3 (note of the resulting C_zO_w material, component C can be Ce).* The resulting applied material can be a stable oxide of C_zO_w , where $C=Ce$, and therefore, Ce in the +4 oxidation state is provided. *Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-45 (as z and w are not defined, it indicates that all possible stable cerium oxides can be used, including CeO_2 , which would be "at once envisaged" from the provided formula, and which would provide Ce in the +4 oxidation state as claimed).* While later reaction of the Ce_zO_w and the primary ceramic is provided, at this point, Ce_zO_w is provided as a coating, which is all that is required by the claim.

Claim 2: the article is a nickel base superalloy article. *Column 3, lines 50-68.*

Claim 3: the article is in the form of a component for a gas turbine engine.
Column 3, lines 50-68.

Claim 4: the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat. *Column 4, lines 5-20.*

Claim 5: the primary ceramic coating can be yttria stabilized zirconia. *Column 2, lines 40-50.*

Claim 7: to provide the cerium oxide material on the primary ceramic, a precursor for the material can be infiltrated into the exposed surface of the primary ceramic coating. *Figures 2-3 and column 4, line 55 through column 5, line 5.*

Claim 9: Subramanian teaches a method for preparing a protected article. *Column 2, lines 20-40.* A nickel base superalloy article that is a component in a gas turbine engine is provided. *Column 3, lines 50-68.* A bond coat is deposited on an exposed surface of the article. *Column 4, lines 5-20 and figure 2.* A thermal barrier coating is provided on an exposed surface of the bond coat. *Figure 2 and column 4, lines 50-65.* To form the barrier coating, first, preferably, a yttria stabilized zirconia primary ceramic coating is applied onto the exposed surface on the bond coat. *Column 2, lines 25-45.* Then a cerium oxide precursor material can be infiltrated into the primary ceramic coating. *Column 4, lines 55-68, column 5, lines 35-45 and figures 2-3 (cerium (Ce) can be provided as component C of the sheath material, thus providing Ce_zO_w). The resulting applied material can be a stable oxide of C_zO_w , where $C=Ce$, and therefore, Ce in the +4 oxidation state is provided. Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-45 (as z and w are not defined, it indicates that all possible stable cerium oxides can be used, including CeO_2 , which would be "at once envisaged" from the provided formula, and which would provide Ce in the +4 oxidation state as claimed).* While later reaction of the Ce_zO_w and the primary ceramic is provided, at this point, Ce_zO_w is provided as a coating, which is all that is required by the claim.

Subramanian teaches all the features of these claims except that (1) in order to provide the cerium oxide coating, there is the application of a non cerium oxide precursor and heating to form cerium oxide in a +4 oxidation state an oxygen containing atmosphere and (2) that the precursor is $(\text{NH}_4)\text{Ce}(\text{SO}_4)_3$ (ammonium cerium sulfate) (claims 6 and 11). Subramanian does teaches to infiltrate the material used to form the Ce_2O_w oxide (*column 4, lines 55-68*) and that this material can be applied as a liquid (*column 4, lines 60-68, the sol-gel method*).

However, Ueda teaches that cerium oxide can be provided by providing a precursor of the oxide in liquid, and that a well known cerium compound precursor for this purpose that converts to cerium oxide by calcining is ammonium cerium sulfate. *See column 4, lines 20-30*. The calcining provides heating to perform the conversion. *Column 4, lines 20-30 and 40-50*. Heating methods include vacuum and non vacuum heating devices (which would provide heating in air). *See column 4, lines 60-68*.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Subramanian to initially apply the Ce_2O_w (cerium oxide) to the primary ceramic by applying a precursor in the form of ammonium cerium sulfate in liquid and then heating in air to form the cerium oxide that will later react with the primary ceramic as suggested by Ueda to provide a desirable coating application system, because Subramanian teaches application of the Ce_2O_w by infiltrating the material used to form the Ce_2O_w oxide (*column 4, lines 55-68*) and that this material can be applied as a liquid (*column 4, lines 60-68, the sol-gel method*), thus

indicating that liquid precursor can be applied and heated to form the cerium oxide material that later reacts, and Ueda teaches that it is known to provide a precursor compound of cerium oxide in the form of a liquid containing ammonium cerium sulfate and then heating/calcining in an air environment to form cerium oxide. This process of Ueda would further provide CeO_2 in the +4 oxidation state as the optional Ce_2O_3 oxide, because the use of ammonium cerium sulfate as the precursor material followed by the heating/calcining in air would inherently form CeO_2 .

3. Claim 10 stands finally rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian in view of Ueda as applied to claims 1-7, 9 and 11 above, and further in view of Taylor et al (US 5520516).

Subramanian in view of Ueda teaches all the features of these claims except that the primary ceramic coating of yttria stabilized zirconia has about 7 percent yttria by weight.

However, Taylor teaches applying a yttria stabilized zirconia coat onto a bond coating on a gas turbine engine component. *Column 5, lines 20-40*. The zirconia coat is desirably 7 percent yttria by weight. *Column 5, lines 20-40*.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Subramanian in view of Ueda to use yttria stabilized zirconia with 7 percent yttria by weight as the primary ceramic as suggested by Taylor to provide a desirable coating system, because Subramanian in view of Ueda teaches

that yttria stabilized zirconia can be used on turbine components when forming thermal barrier coatings, and Taylor teaches that a desirable percentage of yttria in zirconia when coating yttria stabilized zirconia on turbine components is 7 percent by weight.

NEW GROUNDS OF REJECTION

(A) Claims 13-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Subramanian (US 6296945) in view of Stoffer et al (US 5932083).

Claim 13: Subramanian teaches a method for preparing a protected article. *Column 2, lines 20-40.* The article is provided. *Column 3, lines 50-68.* A bond coat is deposited onto an exposed surface of the article. *Column 4, lines 5-20 and figure 2.* A thermal barrier coating is formed on an exposed surface of the bond coat. *Column 4, lines 50-65 and figure 2.* To form the thermal barrier coating, first a primary ceramic coating is applied to an exposed surface of the bond coat. *Column 2, lines 25-45 (the "base" or "primary" ceramic is preferably yttria stabilized zirconia, for example).* Then a sintering inhibiting material is applied to the surface of the primary ceramic coating. *Column 2, lines 25-45, column 5, lines 30-65 and figures 2-3 (the sheath material).* The sintering inhibiting region can comprise cerium oxide in a concentration greater than a general cerium oxide concentration in the primary ceramic coating. *Column 2, line 65 through column 3, line 10 and column 5, lines 30-50 (cerium (Ce) can be provided as component C of the sheath material, thus providing Ce_2O_3 , and furthermore, C is desirably not the A or B material of the primary ceramic (A = zirconia and B=yttria if yttria stabilized zirconia is used as*

Art Unit: 1762

the primary ceramic, for example)). The resulting applied material can be a stable oxide of C_zO_w , where $C=Ce$, and therefore, Ce in the +4 oxidation state is provided. Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-45 (as z and w are not defined, it indicates that all possible stable cerium oxides can be used, including CeO_2 , which would be "at once envisaged" from the provided formula, and which would provide Ce in the +4 oxidation state as claimed).

Claim 14: the article is a nickel base superalloy article. *Column 3, lines 50-68.*

Claim 15: the article is in the form of a component for a gas turbine engine.

Column 3, lines 50-68.

Claim 16: the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat. *Column 4, lines 5-20.*

Claim 17: the primary ceramic coating can be yttria stabilized zirconia. *Column 2, lines 40-50.*

Under the procedure set forth in MPEP 2131.01, section III "To show that a characteristic not disclosed in the reference is inherent", Stoffer has been cited. Stoffer indicates that cerium possesses two highly stable oxides, CeO_2 or Ce_2O_3 , in the oxidation states of 3 and 4. *See column 2, lines 45-55.* Thus, Stoffer clarifies that when a "stable cerium oxide" is referred to (as described in Subramanian), one of these two listed cerium oxides would be what is "at once envisaged", thus providing the use of CeO_2 with a resulting cerium oxidation state of +4.

In the alternative to (A) above:

(B) Claims 13-17 are rejected under 35 U.S.C. 103 as being unpatentable over Subramanian (US 6296945) in view of Stoffer et al (US 5932083).

Claim 13: Subramanian teaches a method for preparing a protected article. *Column 2, lines 20-40.* The article is provided. *Column 3, lines 50-68.* A bond coat is deposited onto an exposed surface of the article. *Column 4, lines 5-20 and figure 2.* A thermal barrier coating is formed on an exposed surface of the bond coat. *Column 4, lines 50-65 and figure 2.* To form the thermal barrier coating, first a primary ceramic coating is applied to an exposed surface of the bond coat. *Column 2, lines 25-45 (the "base" or "primary" ceramic is preferably yttria stabilized zirconia, for example).* Then a sintering inhibiting material is applied to the surface of the primary ceramic coating. *Column 2, lines 25-45, column 5, lines 30-65 and figures 2-3 (the sheath material).* The sintering inhibiting region can comprise cerium oxide in a concentration greater than a general cerium oxide concentration in the primary ceramic coating. *Column 2, line 65 through column 3, line 10 and column 5, lines 30-50 (cerium (Ce) can be provided as component C of the sheath material, thus providing Ce_zO_w , and furthermore, C is desirably not the A or B material of the primary ceramic (A = zirconia and B=yttria if yttria stabilized zirconia is used as the primary ceramic, for example)).* The resulting applied material can be a stable oxide of C_zO_w , where $C=Ce$. *Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-4.*

Claim 14: the article is a nickel base superalloy article. *Column 3, lines 50-68.*

Claim 15: the article is in the form of a component for a gas turbine engine.

Column 3, lines 50-68.

Claim 16: the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat. *Column 4, lines 5-20.*

Claim 17: the primary ceramic coating can be yttria stabilized zirconia. *Column 2, lines 40-50.*

Subramanian can be considered as teaching all the features of these claims except that the selected stable oxide of cerium is such that a +4 oxidation state of cerium is used.

However, Stoffer indicates that cerium possesses two highly stable oxides, CeO_2 or Ce_2O_3 , in the oxidation states of 3 and 4. *See column 2, lines 45-55.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Subramanian to select CeO_2 as the stable oxide of cerium to be used as suggested by Stoffer in order to provide a desirable sheath coating of cerium oxide, because Subramanian teaches to use a stable oxide of cerium as the coating material, and Stoffer teaches that a well known highly stable oxide of cerium is CeO_2 , which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state).

(C) Claims 1-7, 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian (US 6296945) in view of Stoffer (US 5932083) and Ueda et al (US 5697992).

Claim 1: Subramanian teaches a method for preparing a protected article. *Column 2, lines 20-40*. The article is provided. *Column 3, lines 50-68*. A bond coat is deposited onto an exposed surface of the article. *Column 4, lines 5-20 and figure 2*. A thermal barrier coating is formed on an exposed surface of the bond coat. *Column 4, lines 50-65 and figure 2*. To form the thermal barrier coating, first a primary ceramic coating is applied to an exposed surface of the bond coat. *Column 2, lines 25-45 (the "base" or "primary" ceramic is preferably yttria stabilized zirconia, for example)*. Then a cerium oxide compound can be applied to the surface of the primary ceramic coating. *Column 2, lines 25-45, column 4, lines 55-68, column 5, lines 30-65 and figures 2-3 (cerium (Ce) can be provided as component C of the sheath material, thus providing Ce_zO_w)*. The cerium oxide precursor material can be infiltrated into the primary ceramic coating. *Column 4, lines 55-68, column 5, lines 35-45 and figures 2-3 (note of the resulting C_zO_w material, component C can be Ce)*. The resulting applied material can be a stable oxide of C_zO_w , where $C=Ce$, and therefore, Ce in the +4 oxidation state is provided. *Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-45 (as z and w are not defined, it indicates that all possible stable cerium oxides can be used, including CeO_2 , which would be "at once envisaged" from the provided formula, and which would provide Ce in the +4 oxidation state as claimed)*. While

later reaction of the Ce_2O_w and the primary ceramic is provided, at this point, Ce_2O_w is provided as a coating, which is all that is required by the claim.

Claim 2: the article is a nickel base superalloy article. *Column 3, lines 50-68.*

Claim 3: the article is in the form of a component for a gas turbine engine.

Column 3, lines 50-68.

Claim 4: the step of depositing the bond coat includes depositing an aluminum containing overlay bond coat. *Column 4, lines 5-20.*

Claim 5: the primary ceramic coating can be yttria stabilized zirconia. *Column 2, lines 40-50.*

Claim 7: to provide the cerium oxide material on the primary ceramic, a precursor for the material can be infiltrated into the exposed surface of the primary ceramic coating. *Figures 2-3 and column 4, line 55 through column 5, line 5.*

Claim 9: Subramanian teaches a method for preparing a protected article. *Column 2, lines 20-40.* A nickel base superalloy article that is a component in a gas turbine engine is provided. *Column 3, lines 50-68.* A bond coat is deposited on an exposed surface of the article. *Column 4, lines 5-20 and figure 2.* A thermal barrier coating is provided on an exposed surface of the bond coat. *Figure 2 and column 4, lines 50-65.* To form the barrier coating, first, preferably, a yttria stabilized zirconia primary ceramic coating is applied onto the exposed surface on the bond coat. *Column 2, lines 25-45.* Then a cerium oxide precursor material can be infiltrated into the primary ceramic coating. *Column 4, lines 55-68, column 5, lines 35-45 and figures 2-3 (cerium (Ce) can be*

Art Unit: 1762

provided as component C of the sheath material, thus providing Ce_zO_w). The resulting applied material can be a stable oxide of C_zO_w , where $C=Ce$. Column 2, lines 35-40, column 4, lines 55-65 and column 5, lines 35-45. While later reaction of the Ce_zO_w and the primary ceramic is provided, at this point, Ce_zO_w is provided as a coating, which is all that is required by the claim.

Subramanian teaches all the features of these claims except that (1) in order to provide the cerium oxide coating, there is the application of a non cerium oxide precursor and heating to form cerium oxide in a +4 oxidation state an oxygen containing atmosphere, (2) that a stable form of cerium oxide is specifically CeO_2 and (3) that the precursor is $(NH_4)Ce(SO_4)_3$ (ammonium cerium sulfate) (claims 6 and 11). Subramanian does teaches to infiltrate the material used to form the C_zO_w oxide (*column 4, lines 55-68*) and that this material can be applied as a liquid (*column 4, lines 60-68, the sol-gel method*).

However, Stoffer indicates that cerium possesses two highly stable oxides, CeO_2 or Ce_2O_3 , in the oxidation states of 3 and 4. *See column 2, lines 45-55.*

Ueda teaches that cerium oxide can be provided by providing a precursor of the oxide in liquid, and that a well known cerium compound precursor for this purpose that converts to cerium oxide by calcining is ammonium cerium sulfate. *See column 4, lines 20-30.* The calcining provides heating to perform the conversion. *Column 4, lines 20-30 and 40-50.* Heating methods include vacuum and non vacuum heating devices (which would provide heating in air). *See column 4, lines 60-68.*

It would have been clear to one of ordinary skill in the art at the time the invention was made to either (1) under the procedure set forth in MPEP 2131.01, section III "To show that a characteristic not disclosed in the reference is inherent", use the teaching of Stoffer indicating that cerium possesses two highly stable oxides, CeO_2 or Ce_2O_3 , in the oxidation states of 3 and 4 to clarify that when a "stable cerium oxide" is referred to, as described in Subramanian, one of these two listed cerium oxides would be what is "at once envisaged", thus providing the use of CeO_2 , with a resulting cerium oxidation state of +4 or (2) obvious to modify Subramanian to select CeO_2 as the stable oxide of cerium to be used as suggested by Stoffer in order to provide a desirable sheath coating of cerium oxide, because Subramanian teaches to use a stable oxide of cerium as the coating material, and Stoffer teaches that a well known highly stable oxide of cerium is CeO_2 , which would have cerium in a +4 oxidation state (as oxygen has a +2 valence state). It further would have been obvious to modify Subramanian in view of Stoffer to initially apply the Ce_zO_w (cerium oxide) to the primary ceramic by applying a precursor in the form of ammonium cerium sulfate in liquid and then heating in air to form the cerium oxide that will later react with the primary ceramic as suggested by Ueda to provide a desirable coating application system, because Subramanian in view of Stoffer teaches application of the Ce_zO_w by infiltrating the material used to form the Ce_zO_w oxide (*column 4, lines 55-68*) and that this material can be applied as a liquid (*column 4, lines 60-68, the sol-gel method*), thus indicating that liquid precursor can be applied and heated to form the cerium oxide material that later reacts, and Ueda teaches that it is

known to provide a precursor compound of cerium oxide in the form of a liquid containing ammonium cerium sulfate and then heating/calcining in an air environment to form cerium oxide. This process of Ueda would further provide CeO_2 in the +4 oxidation state as the optional Ce_2O_3 oxide, because the use of ammonium cerium sulfate as the precursor material followed by the heating/calcining in air would inherently form CeO_2 .

(D) Claim 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian in view of Stoffer and Ueda as applied to claims 1-7, 9 and 11 in section (C) above, and further in view of Taylor et al (US 5520516).

Subramanian in view of Stoffer and Ueda teaches all the features of these claims except that the primary ceramic coating of yttria stabilized zirconia has about 7 percent yttria by weight.

However, Taylor teaches applying a yttria stabilized zirconia coat onto a bond coating on a gas turbine engine component. *Column 5, lines 20-40*. The zirconia coat is desirably 7 percent yttria by weight. *Column 5, lines 20-40*.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Subramanian in view of Stoffer and Ueda to use yttria stabilized zirconia with 7 percent yttria by weight as the primary ceramic as suggested by Taylor to provide a desirable coating system, because Subramanian in view of Stoffer and Ueda teaches that yttria stabilized zirconia can be used on turbine components

when forming thermal barrier coatings, and Taylor teaches that a desirable percentage of yttria in zirconia when coating yttria stabilized zirconia on turbine components is 7 percent by weight.

(10) Response to Argument

Ground 1. The rejection of claims 13-17 under 35 USC 102 over Subramanian (US 6,296,945)

Appellant's Arguments as to claims 13-17

Appellant argues that Subramanian does not disclose cerium in the +4 oxidation state as required by independent claim 13. Appellant argues that in the Final Office Action, the Examiner explicitly admits this to be the case, where, in making the rejection that forms the subsequent Ground 2 of this Appeal, the Examiner states "Subramanian teaches all of the features of these claims except (1) the application of a non cerium oxide precursor and heating to form cerium oxide in a +4 oxidation state . . ." (Final Office Action, page 6, lines 5-7). Since claim 13 recites "sintering-inhibitor region comprises cerium oxide with cerium in the +4 oxidation state," the Examiner's rejection under 35 USC 102 cannot be maintained, according to appellant.

Appellant further argues that as to the references to column 2, line 65 – column 3, line 10 and column 5, lines 40-50 of Subramanian to support the rejection of the +4 oxidation state limitation, these portions of Subramanian make no reference to the oxidation state, and give no composition suggesting that cerium might be in the +4

oxidation state. Appellant argues that Subramanian teaches C_zO_w compounds as precursors of another reaction, without ever defining z or w or giving any range of values when $C=Ce$. The selection of the +4 oxidation state is not a matter of design choice, because Subramanian does not present any such design choice. All of Subramanian's discussion is in general terms, it does not set forth specific compounds and valence states.

Appellant notes that in the Response to Arguments in the paragraph bridging pages 8-9 of the Final Office Action, the Examiner states that "Since Subramanian puts no limits on z and w , it would indicate that all possible numbers for z and w are present. . .". Appellant argues that this position is contrary to law and to the MPEP 2131, as it provides "The identical invention must be shown in as complete detail as is contained in the . . . claim. The elements must be arranged as required by the claim . . .". According to appellant, the Examiner's argument is contrary to this provision of the MPEP, as the inability of a prior art reference to define a particular compound may not be taken as evidence that the prior art has defined the particular compound. Further, according to appellant, there is no reason to believe that Subramanian contemplates that z and w can include all possible numbers for z and w . Appellant further notes that in the Advisory Action of September 19, 2005, the Examiner attempts to overcome this deficiency by portraying the present rejection as falling within the genus/species situation of MPEP 2131.02, in which "[a] generic chemical formula will anticipate a claimed species covered by the formula when the species can be 'at once envisaged'

Art Unit: 1762

from the formula.” Appellant argues that the attempt to rely upon this principle is misplaced for two reasons. First, Subramanian speaks only of “ C_zO_w ” compounds without ever giving any value or range of values for z and w , and therefore, it cannot be said that any generic interpretation of “ C_zO_w ” necessarily encompasses the values required to anticipate “cerium oxide with cerium in the +4 oxidation state”, e.g., $C=Ce$, $z=1$ and $w=2$. Second, for this principle to apply, an appropriate generic compound that encompasses the claimed compound (which, “ C_zO_w ”, with values of z and w unspecified, does not) must be a “limited generic class” and not a “vast number or perhaps even an infinite number of compounds”. Appellant argues that “ C_zO_w ” covers a vast number, in fact, an infinite number of compounds: “ C ” may be any of a long list of elements and Subramanian gives no reason to interpret z and w as being limited only to integers, and therefore, “ z ” and “ w ” can include infinitesimally graded compositional steps. If a formula covers a vast or infinite number of species, then the genus does not make a particular species “at once envisaged” as it would if the genus covered a relatively limited number of species.

The Examiner's Response as to claims 13-17

The Examiner has reviewed appellant's arguments, however, the rejection is maintained. As to appellant's first argument, that the Examiner admits that Subramanian does not disclose cerium in the +4 oxidation state as claimed (as indicated in making the rejection that forms the subsequent Ground 2 of this Appeal, where the Examiner states “Subramanian teaches all of the features of these claims except (1) the

application of a non cerium oxide precursor and heating to form cerium oxide in a +4 oxidation state . . .”), the Examiner disagrees with appellant’s argument. In claim 13 all that is required as to cerium in the +4 oxidation state is “a sintering-inhibitor region at a surface of the primary ceramic coating, wherein the sintering-inhibitor region comprises cerium oxide with cerium in the +4 oxidation state in a concentration greater than a general cerium oxide concentration in the primary ceramic coating”. Thus, while still meeting the requirements of claim 13, the cerium oxide in the sintering-inhibitor region as claimed could be applied to the primary ceramic simply as cerium oxide in the +4 oxidation state. On the other hand, in claims 1 and 9, a cerium oxide precursor compound that “is not cerium oxide with cerium in the +4 oxidation state” must be applied, and this must be heated to form the cerium oxide with cerium in the +4 oxidation state. Neither the precursor compound or the heating is required by claim 13. Thus, the Examiner’s statement that “Subramanian teaches all of the features of these claims except (1) the application of a non cerium oxide precursor and heating to form cerium oxide in a +4 oxidation state . . .” in reference to claims 1 and 9 does not mean that the features of claim 13, requiring simply the presence of cerium oxide with cerium in the +4 oxidation state, cannot be provided by Subramanian. In fact, in the *Grounds of Rejection* above (as to claim 13), the Examiner has pointed out where all the claimed features of claim 13 are specifically provided in Subramanian.

The Examiner further disagrees with appellant’s argument that Subramanian does not teach the “a sintering-inhibitor region at a surface of the primary ceramic

coating, wherein the sintering-inhibitor region comprises cerium oxide with cerium in the +4 oxidation state in a concentration greater than a general cerium oxide concentration in the primary ceramic coating" as required by claim 13. As discussed in the *Grounds of Rejection* above (as to claim 13), Subramanian specifically teaches the use of C_zO_w compounds, and that C can be Ce, thus providing the use of Ce_zO_w , which would be various cerium oxides (as well, as also discussed, Subramanian teaches that "C" is preferably not the primary ceramic material, so "Ce" in the sheath material would be in a greater concentration than in the primary ceramic). The question that remains would be does the teaching of Ce_zO_w as provided by Subramanian further provide a teaching of using cerium in a +4 oxidation state in forming the cerium oxides? It is the Examiner's position that it would be "at once envisaged" that the use of CeO_2 , ($z = 1$, $w = 2$) for example, is contemplated, which provides anticipation of the claimed feature, as the use of CeO_2 provides cerium in a +4 oxidation state. It is the Examiner's position that support for this understanding is provided by MPEP 2131.02, in the section entitled "A generic chemical formula will anticipate a claimed species covered by the formula when the species can be "at once envisaged" from the formula". To clarify why this would be the case, the Examiner notes that Subramanian teaches the following of C_zO_w -- (1) first that C_zO_w can be Ce_zO_w (as shown by column 5, lines 35-45), and (2) secondly, C_zO_w is a stable oxide (see column 2, lines 35-40 and column 3, lines 5-10). Thus, one of ordinary skill in the art would note the teaching of using Ce_zO_w and that this would have to be a stable oxide. One of ordinary skill in the art

would understand that z and w would be referring to numbers used in indicating the relative amounts of the two materials, as this is standard for chemical nomenclature.

Thus, the possible numbers for z and w for Ce_zO_w of Subramanian would be all possible numbers of z and w that would provide stable oxides. This results in a "limited generic class", not an overwhelming vast or infinite number, because only stable oxides would be used, not "infinitesimally graded compositional steps" as these would not provide stable oxides. Of all possible stable oxides, the simplest, $z=1$ and $w=2$ would be the immediate oxide that would be "at once envisaged".

The Examiner also notes the **NEW GROUNDS OF REJECTION** above as to the use of Stoffer also clarifies that CeO_2 would be a well recognized and "at once envisaged" stable oxide of cerium

Ground 2. The rejection of claims 1-7, 9 and 11 under 35 USC 102 using Subramanian (US 6,296,945) in view of Ueda et al (US 5,697,992)

Appellant's Arguments as to claims 1-7

Appellant argues that Ueda is non-analogous art. Appellant argues that Ueda is not concerned with the same problem as another reference and the claims which are being addressed. In the present case, appellant argues, the inventors were concerned with thermal barrier coatings, such as those being applied to turbine blades and other structures. Subramanian was also concerned with thermal barrier coatings. However, Ueda deals with abrasive particles and has absolutely nothing to do with thermal

barrier coatings or similar structures, and therefore, is not properly within the scope of the prior art. According to appellant, a person seeking to improve thermal barrier coatings would have no reason to look at a reference discussing abrasive particles, much less look to Ueda and then attempt to extract his teachings regarding abrasives and then try to apply them to the technology of thermal barrier coatings.

Appellant further argues that even if Ueda was properly applied in forming the rejection, the combination of its teachings with Subramanian still does not teach the claim limitations of appellant's claimed invention. In the present approach, a cerium oxide precursor compound that is not itself cerium oxide with cerium in the +4 oxidation state is deposited on the surface of a primary thermal barrier coating, and then the cerium oxide precursor is reacted to form cerium oxide with cerium in the +4 oxidation state, with the present specification indicating the reasons for this approach and improved results from this approach. However, according to appellant, Subramanian deposits a compound that may be a cerium containing compound of cerium and oxygen overlying an oxide thermal barrier coating material and then reacts the cerium containing compound with the thermal barrier coating material to make a more complex oxide. In Subramanian, the term "precursor" refers to a cerium-oxygen compound that is reacted with another oxide to form a reaction product, while in the present application the term "precursor" refers to a compound that reacts to form cerium oxide. There is no teaching in Subramanian of producing cerium in the +4 oxidation state, which achieves important advantages as set forth in paragraphs [0012]

Art Unit: 1762

and [0030] of the present specification. While Ueda teaches that a compound that is not cerium oxide can be converted to cerium oxide, the teaching has no relevance to the teachings of Subramanian, as it never teaches converting anything that is not cerium oxide to cerium oxides, but in fact, starts with a cerium-oxygen compound of the form C_zO_w , without ever defining z and w when $C=Ce$, and then reacts the cerium-oxygen compound with another oxide to get a more complex oxide reaction product.

Consequently, there is no motivation or objective basis for combining the teachings of these references. The explanation of the rejection by the Examiner has been that Ueda teaches the formation of CeO_2 , however appellant argues that there is no teaching of CeO_2 in Ueda, nor any teaching of "cerium oxide in a +4 oxidation state."

Appellant further argues that the Advisory Action of September 19, 2005 makes a new and unfounded assertion that that Ueda's approach "would inherently provide CeO_2 ", which appellant traverses as an attempt to raise a new basis for rejection pertaining to "inherency" for the first time in the Advisory Action. Appellant argues that inherency is improperly asserted unless there is good evidence to suggest the asserted property or characteristic is necessarily present in the teachings of the prior art reference. Appellant argues that the Examiner has not shown that the results must occur and has not provided a basis in fact and/or technical reasoning to reasonably support the determination that the inherent characteristic necessarily flows from the applied prior art.

Appellant further argues that the present rejection seeks to perform a hindsight reconstruction based upon unrelated references, which is technically unsupported and legally improper. Appellant cites case law as to a proper 35 USC 103 rejection and argues that in the present case, there is set forth no objective basis for combining the teachings of the references in the manner used by this reaction. As discussed above, Subramanian deals with thermal barrier coatings and Ueda deals with abrasives and a person of ordinary skill in the art would have no reason to attempt to combine these teachings. Additionally, according to appellant, the technical teachings of the references are inconsistent, as Ueda teaches that a compound that is not cerium oxide can be converted to cerium oxide, and Subramanian never teaches converting something that is not cerium oxide to cerium oxide, but in fact, starts with a cerium-oxygen compound to form C_zO_w , without ever defining z and w when $C=Ce$, and then reacts the cerium-oxygen compound with another oxide to get a more complex oxide reaction product. There is no basis for combining the teachings of these references, according to appellant.

The Examiner's Response as to claims 1-7

The Examiner has reviewed appellant's arguments, however, the rejection is maintained. As to the argument that Ueda is non-analogous art, the Examiner disagrees. It has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for

rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). Furthermore, as noted in MPEP 2141.01(a) "a reference is reasonably pertinent if, even though it may be in a different field from that of inventor's endeavor, is one which, because of the matter with which it deals, logically would have commended itself to an inventor's attention in considering his problem." In this case, Subramanian is clearly within the field of endeavor of applicant, as both are concerned with treating primary layers of thermal barrier coatings with protective material. Furthermore, in order to treat the primary layer of the thermal barrier material with the protective material, the protective material must first be applied to the primary layer. For example, in Subramanian, the initial layer Ce_2O_3 must be applied, and Subramanian teaches that it can be applied as a liquid (see column 4, lines 60-68 – the sol-gel method). The Examiner has cited Ueda as showing that cerium oxide can be provided by providing a precursor of the oxide in a liquid, such as ammonium cerium sulfate, and that this can be converted to cerium oxide by calcining. Thus, this reference is reasonably pertinent, even though it is not concerned with applying protective materials to thermal barrier coatings, because it is one which, because of the matter with which it deals, logically would have commended itself to an inventor's attention in considering his problem. Here, the problem would also be how to apply the initial layer of cerium oxide to the thermal barrier coating, when various methods including liquid application are known, and Ueda shows how a liquid material can be converted to cerium oxide.

As to the argument that the combination of Subramanian and Ueda still does not teach appellant's claimed invention, the Examiner disagrees. The Examiner notes in the present invention a precursor is applied that is converted to cerium oxide in the +4 oxidation state. The Examiner further notes that after applying the cerium oxide composition in Subramanian, the cerium oxide would be further reacted with the thermal barrier material in the process of Subramanian. However, in Subramanian, as discussed at column 4, lines 55-68, the Ce_2O_w must be initially applied to the primary ceramic of the thermal barrier layer before the further reacting occurs, thus providing a coating of Ce_2O_w on the thermal barrier layer, and the claims of the present application do not prevent a later reaction and treatment of the cerium oxide material in the +4 oxidation state. Subramanian teaches that the Ce_2O_w material can be deposited by processes which allow for its deposition on top of the column and also its infiltration between the columns of the primary thermal barrier material, such as by CVD or a "sol-gel technique" (column 4, lines 55-68). Thus, Subramanian teaches that the Ce_2O_w has to be applied initially in some method that allows for infiltration and application, and that the method can be a liquid application method. As to the reasoning why Subramanian further teaches that the resulting Ce_2O_w can be CeO_2 with Ce in the +4 oxidation state, please note the full discussion in *The Examiner's Response as to claims 13-17* above. The Examiner has further cited Ueda as providing a liquid material that can be used to form a cerium oxide material using a precursor such as ammonium cerium sulfate, which is heated to provide cerium oxide. Thus, to one of ordinary skill in the art, it

would have been obvious to use a liquid as taught by Ueda to perform the application of the cerium oxide material to the columnar ceramic of Subramanian, because it teaches a desirable liquid method of getting cerium oxide. As ammonium cerium sulfate is used and heated, CeO_2 will be formed, also providing Ce in the +4 oxidation state.

As to appellant's arguments as to the inherency of the provision CeO_2 by Ueda's approach, it is the Examiner's position that it is clearly shown by the process of Ueda. Ueda shows the same material (ammonium cerium sulfate) and heating as shown by applicant in paragraphs [0029] – [0031] of the specification, and as such, one of ordinary skill in the art would understand that duplicate results would be expected from following duplicate processes. The Examiner also takes the position that a further explanation of the grounds for combining Subramanian and Ueda by showing inherent results of the references is not a "new ground of rejection", but rather a clarification of the initial rejection.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA

1971). Here the teachings of relevant art have been provided by Subramanian and Ueda for the reasons given above and in the *Grounds of Rejection* above.

The Examiner also notes the **NEW GROUNDS OF REJECTION** above as to the use of Stoffer also clarifies that CeO_2 would be a well recognized stable oxide of cerium.

Appellant's Arguments as to claims 9 and 11

Appellant argues that the prior arguments with regard to claims 1-7 are incorporated here. Furthermore, Subramanian teaches deposition a compound that may be a cerium containing compound of cerium and oxygen overlying an oxide thermal barrier coating material and then reacts the cerium containing compound with the thermal barrier coating material to make a more complex oxide that is apparently not "cerium oxide with cerium in the +4 oxidation state". In the present claims "precursor" means a compound that is not cerium oxide with cerium in the +4 oxidation state, but reacts to form cerium oxide with cerium in the +4 oxidation state. In Subramanian, the term "precursor" refers to a cerium-oxygen compound that is reacted with another oxide to form a reaction product, thence the cerium-oxygen compound is a precursor to the reaction product. Thus, Subramanian has no teaching that the cerium-oxide-precursor compound is not cerium oxide with cerium in a +4 oxidation state, and that heating in an oxygen containing atmosphere forms cerium oxide with cerium in the +4 oxidation state.

The Examiner's Response as to claims 9 and 11

The Examiner has reviewed appellant's arguments, however, the rejection is maintained. As to the arguments regarding claims 1-7, the rejection of claims 1-7 is maintained for the reasons given in *The Examiner's Response as to claims 1-7* above.

As to the further arguments regarding the precursor of Subramanian and the precursor of the present application, as discussed above regarding claims 1-7, the Examiner notes in the present invention a precursor is applied that is converted to cerium oxide in the +4 oxidation state. The Examiner further notes that after applying the cerium oxide composition in Subramanian, the cerium oxide would be further reacted with the thermal barrier material in the process of Subramanian. However, in Subramanian, as discussed at column 4, lines 55-68, the Ce_2O_w must be initially applied to the primary ceramic of the thermal barrier layer before the further reacting occurs, thus providing a coating of Ce_2O_w on the thermal barrier layer, and the claims of the present application do not prevent a later reaction and treatment of the cerium oxide material in the +4 oxidation state. Subramanian teaches that the Ce_2O_w material can be deposited by processes which allow for its deposition on top of the column and also its infiltration between the columns of the primary thermal barrier material, such as by CVD or a "sol-gel technique" (column 4, lines 55-68). Thus, Subramanian teaches that the Ce_2O_w has to be applied initially in some method that allows for infiltration and application, and that the method can be a liquid application method. As to the reasoning why Subramanian further teaches that the resulting Ce_2O_w can be CeO_2 with Ce in the +4 oxidation state, please note the full discussion in *The Examiner's Response*

as to claims 13-17 above. The Examiner has further cited Ueda as providing a liquid material that can be used to form a cerium oxide material using a precursor such as ammonium cerium sulfate, which is heated to provide cerium oxide. Thus, to one of ordinary skill in the art, it would have been obvious to use a liquid as taught by Ueda to perform the application of the cerium oxide material to the columnar ceramic of Subramanian, because it teaches a desirable liquid method of getting cerium oxide. As ammonium cerium sulfate is used and heated, CeO_2 will be formed, also providing Ce in the +4 oxidation state.

Ground 3. The rejection of claim 10 under 35 USC 103 using Subramanian (US 6,296,945) in view of Ueda et al (US 5,697,992) and further in view of Taylor et al (US 5,520,516)

Appellant's Arguments as to claim 10

Appellant argues that claim 10 depends from claim 9 and incorporates its limitations. According to appellant, the combination of Subramanian and Ueda does not teach these limitations for the reasons stated above, and which are incorporated here. Taylor adds nothing in this regard. Furthermore, appellant argues that there is no objective basis for combining the teachings of Taylor with those of Subramanian and Ueda.

The Examiner's Response as to claim 10

The Examiner has reviewed appellant's arguments, however, the rejection is maintained. As to the arguments regarding claim 9, the rejection of claims 9 is maintained for the reasons given in *The Examiner's Response as to claims 9 and 11* above.

As to the argument that there is no objective basis for combining the teachings of Taylor with those of Subramanian and Ueda, the Examiner notes that no specific problems have been indicated. The Examiner refers to the *Grounds of Rejection* (claim 10) above for the specific basis for the combination of references, and further notes that Taylor is specifically concerned with applying yttria stabilized zirconia coatings to substrates such as turbine blades (see column 1, lines 5-15 and column 3, lines 25-35), just as Subramanian applies yttria stabilized zirconia coatings to turbine blades (see column 2, lines 20-25 and 40-45).

For the above reasons, it is believed that the rejections should be sustained.

This examiner's answer contains a new ground of rejection set forth in section (9) above. Accordingly, appellant must within **TWO MONTHS** from the date of this answer exercise one of the following two options to avoid *sua sponte* **dismissal of the appeal** as to the claims subject to the new ground of rejection:

(1) **Reopen prosecution.** Request that prosecution be reopened before the primary examiner by filing a reply under 37 CFR 1.111 with or without amendment, affidavit or other evidence. Any amendment, affidavit or other evidence must be relevant to the new grounds of rejection. A request that complies with 37 CFR 41.39(b)(1) will be entered and considered. Any request that prosecution be reopened will be treated as a request to withdraw the appeal.

(2) **Maintain appeal.** Request that the appeal be maintained by filing a reply brief as set forth in 37 CFR 41.41. Such a reply brief must address each new ground of rejection as set forth in 37 CFR 41.37(c)(1)(vii) and should be in compliance with the other requirements of 37 CFR 41.37(c). If a reply brief filed pursuant to 37 CFR 41.39(b)(2) is accompanied by any amendment, affidavit or other evidence, it shall be treated as a request that prosecution be reopened before the primary examiner under 37 CFR 41.39(b)(1).

Extensions of time under 37 CFR 1.136(a) are not applicable to the TWO MONTH time period set forth above. See 37 CFR 1.136(b) for extensions of time to reply for

Art Unit: 1762

patent applications and 37 CFR 1.550(c) for extensions of time to reply for ex parte reexamination proceedings.

Respectfully submitted,



KATHERINE BAREFORD
PRIMARY EXAMINER

A Technology Center Director or designee must personally approve the new ground(s) of rejection set forth in section (9) above by signing below:

Conferees:

Timothy Meeks, SPE 1762

Glenn Caldarola, SPE 1764


TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER

APPEAL CONFEREES: Robert J. Warden
Glenn Caldarola
Supervisory Patent Examiner
Technology Center 1700

*Director's Designee for
New Grounds of
Rejection*